- Capital Costs
- Operation and Maintenance Costs
- Extended Life Cycle Costs

The Pilot Study Reports from both manufacturers have been attached in Appendix F of this report.

D. MANUFACTURER PROPOSALS

1. Kruger International Hydrotech Discfilter®

The Discfilter® proposal presents a full scale design including two Model HSF2218-2F units. These units are housed in concrete tanks designed and constructed by others. The proposal also includes an option using stainless steel tanks, however this option is not used moving forward as the preference is to use concrete tanks to house the equipment. These units include 18 filter discs each for a total filter area of 2,170 sq.ft. Of this total filter area, up to 1,410 sq.ft. is submerged. The hydraulic loading rate at the peak hydraulic flow of 6 MGD is 2.95 gpm/ft2. The filters are driven by 1.5 HP pumps and cleaned with a backwash system designed for 119 gpm at 110 psi.

Also included in the proposal are design criteria for the coagulation and flocculation zones and polymer makeup system. Appendix G includes the information received as part of this package, including preliminary drawings.

The proposal outlines the budgetary capital and O&M costs for the filter system. The cost does not include the coagulation and flocculation zones and polymer makeup system. The capital costs include only manufacture and delivery to the site. Chapter 6 will develop costs for the complete installation and present worth. The budgetary capital cost for a Discfilter® system is $668,400. The budgetary O&M cost for the Discfilter® system increases as the system gets older. At its maximum, the estimated annual O&M cost is approximately $7,000.

2. Inflico Degremont DensaDeg®

The DensaDeg® proposal includes a full scale design including two Model 7 units housed in concrete tanks designed and constructed by others. Included in the scope of the proposal are a mixer, reactor equipment, clarifier equipment, recycle pumps, control panel, and walkway. Not included in the proposal are the concrete, piping, installation, chemical feed systems, sludge blowdown equipment, valves, electrical equipment, and other appurtenances. Appendix G includes the information received as part of the proposal, including preliminary drawings.

The mixer included is a 2-HP rapid speed mixers suited for a variable speed drive. The reactor includes an inner draft tube for proper recirculation and flocculation, a 2-HP reactor turbine for mixing, and polymer distribution piping. The clarifier includes a 0.5-HP scraper mechanism and drive, tube settling modules, effluent collection troughs, adjustable sludge draw-off, and a sampling system. Three, 5-HP progressive cavity recycle pumps are included in the proposal as well. The control panel included contains an Allen-Bradley PLC and PanelView HMI.

The proposal outlines the budgetary capital costs for the ballasted flocculation system. The capital costs include only manufacture and delivery to the site. Chapter 6 will develop costs for the complete installation and present worth. The budgetary capital cost for a DensaDeg® system is $740,000.

E. CONCLUSIONS

Figures 5-1 through 5-7 present some of the data from Table 5-4 in graphical form. Figures 5-1 and 5-2 show influent and effluent total phosphorous and coagulant dose for the Kruger Discfilter and IDI DensaDeg systems respectively. It is clear that each technology can meet the permit limit of 0.42 mg/L with the proper coagulant dose using either an iron or aluminum based coagulant. Each process also responds well to an increase in coagulant to a point. It appears that for each process the maximum practical coagulant dose is approximately 80 mg/L before the amount of phosphorous removal becomes negligible. At this dosage, the effluent phosphorous was between 0.1 and 0.2 mg/L. Effluent values will not likely decrease substantially lower no matter how much coagulant is added. The DiscFilter process operated well with coagulant doses somewhat lower than that of the DensaDeg process, but this may be partially due to the shortened time schedule for the DensaDeg unit.

Figures 5-3, 5-4 and 5-5 show relationships between effluent total phosphorous and water temperature, pH, and TSS respectively. Based on the relatively small sample size of data, there are no apparent relationships between these factors. Flow temperature ranged between approximately 8 and 11 degC and the change in temperature did not seem to have any effect on the water chemistry behind coagulation or the processes tested. pH stayed relatively constant between 7.1 and 7.3 and again there is no apparent relationship in the data between pH and effluent total phosphorous. Lastly, effluent TSS varied between approximately 5 and 9 mg/L. Both processes did an excellent job at removing TSS but there is not an apparent relationship between greater TSS removal and greater TP removal in the data.

Figure 5-6 compares measured UV Transmittance (UVT) values with effluent total phosphorous. UVT was measured in the effluent of each of the pilots and shows a dramatic improvement over the existing UV system design values. The existing UV disinfection system has been designed with an UVT of 40%. The measured values from the pilot show that the effluent UVT varies between 60 and 80%. An increase in UVT of even 10% can dramatically decrease the capital cost and energy use of the system. As expected, UVT increases as effluent total phosphorous decreases.

Lastly, Figure 5-7 shows the impact of the alum coagulant dose versus the effluent aluminum. Effluent aluminum is important because if it is used as a coagulant, a monthly average discharge limit for aluminum will likely be imposed. More details on the potential limit are presented in Chapter 6, however based on these results it is unlikely that the use of an aluminum based coagulant would exceed permit limitations if they are enacted.

In conclusion, both technologies demonstrated that they have the capability of reaching an effluent total phosphorus level of 0.42 mg/L or less with either aluminum or iron based coagulants. Recognizing that pilot results show that the use of an aluminum based coagulant will not exceed future aluminum permit limits, AECOM recommends using aluminum based coagulants over iron based coagulants, mostly because iron has a negative effect on the efficiency of ultraviolet radiation.

Chapter 6 will evaluate the two piloted processes using both a present worth analysis to determine which offers the Town the greatest value.

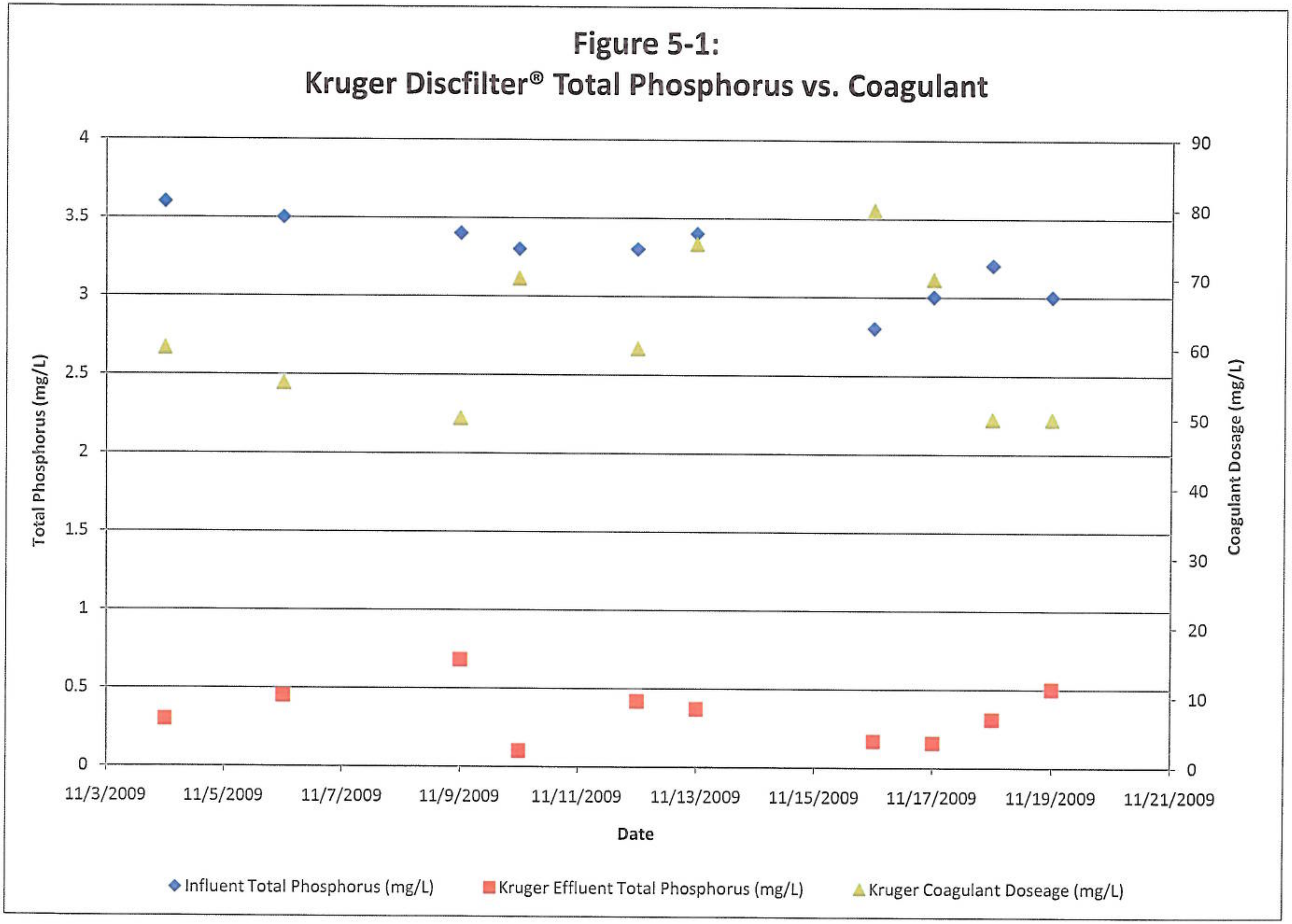


Figure 5-1:
Kruger Discfilter® Total Phosphorus vs. Coagulant
Total Phosphorus (mg/L)
Coagulant Dosage (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
0
10
20
30
40
50
60
70
80
90
11/3/2009
11/5/2009
11/7/2009
11/9/2009
11/11/2009
11/13/2009
11/15/2009
11/17/2009
11/19/2009
11/21/2009
Date
Influent Total Phosphorus (mg/L)
Kruger Effluent Total Phosphorus (mg/L)
Kruger Coagulant Doseage (mg/L)

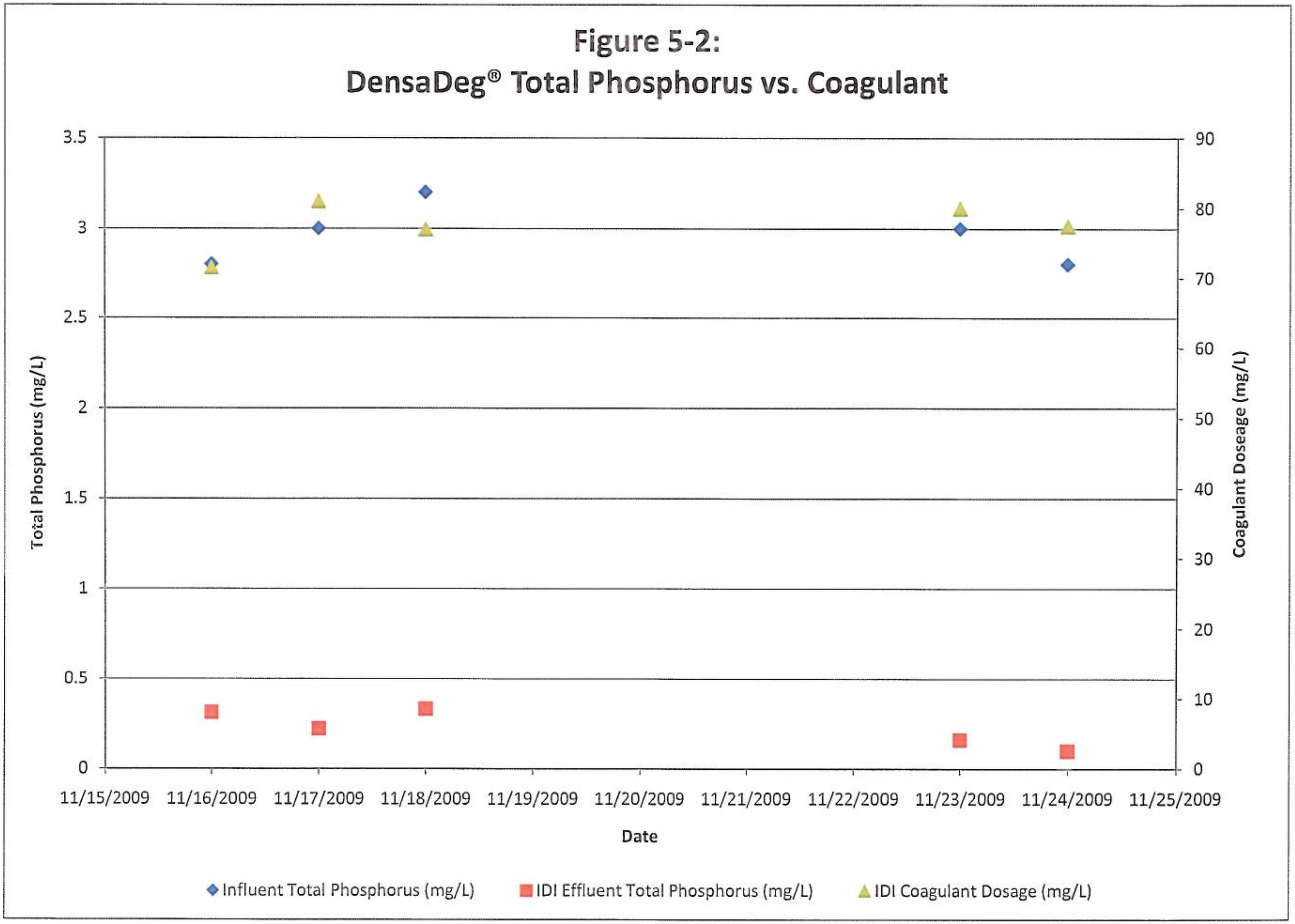


Figure 5-2:
DensaDeg® Total Phosphorus vs. Coagulant
Total Phosphorus (mg/L)
3.5
3
2.5
2
1.5
1
0.5
0
Coagulant Doseage (mg/L)
90
80
70
60
50
40
30
20
10
0
11/15/2009
11/16/2009
11/17/2009
11/18/2009
11/19/2009
11/20/2009
11/21/2009
11/22/2009
11/23/2009
11/24/2009
11/25/2009
Date
Influent Total Phosphorus (mg/L)
IDI Effluent Total Phosphorus (mg/L)
IDI Coagulant Dosage (mg/L)

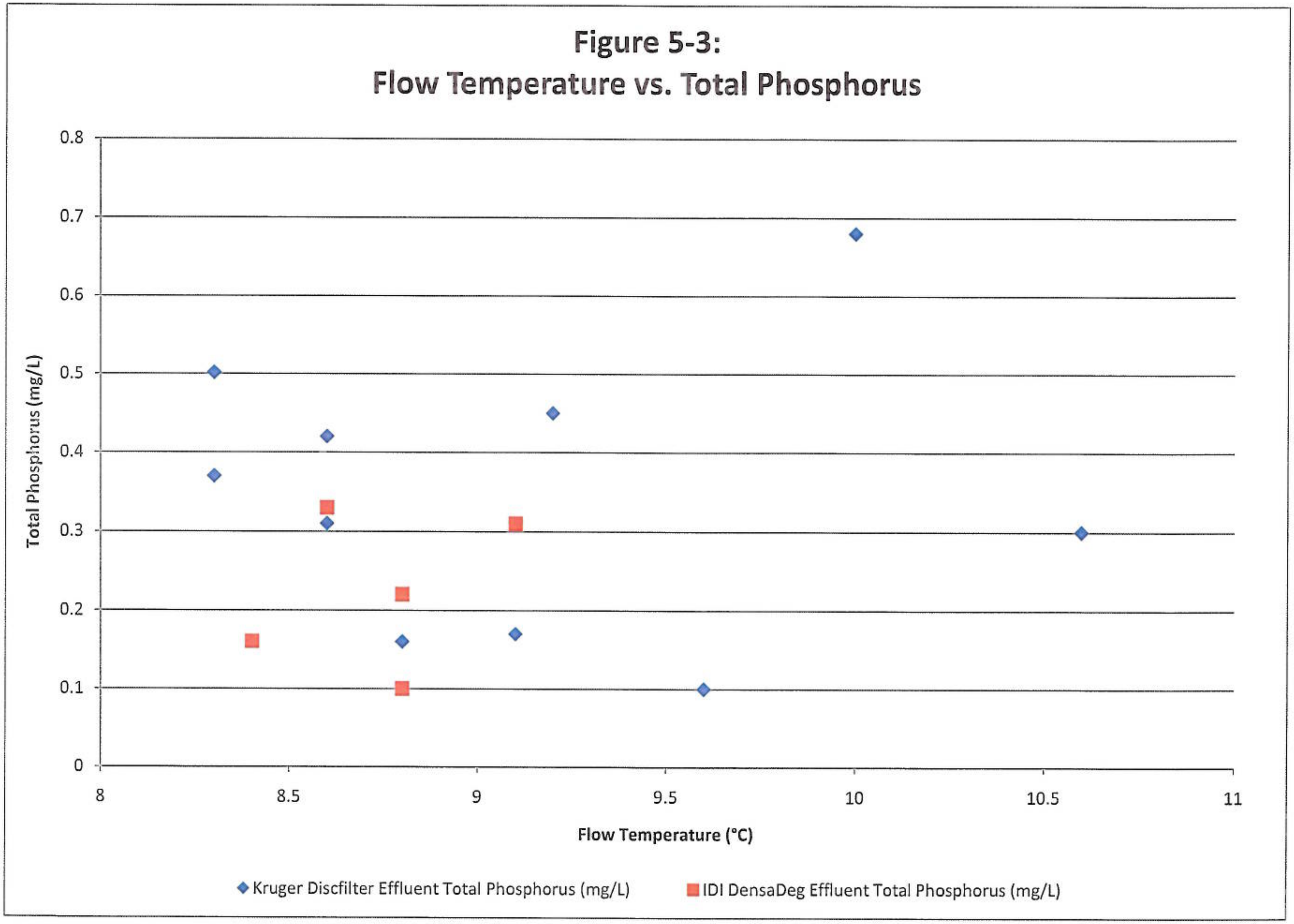
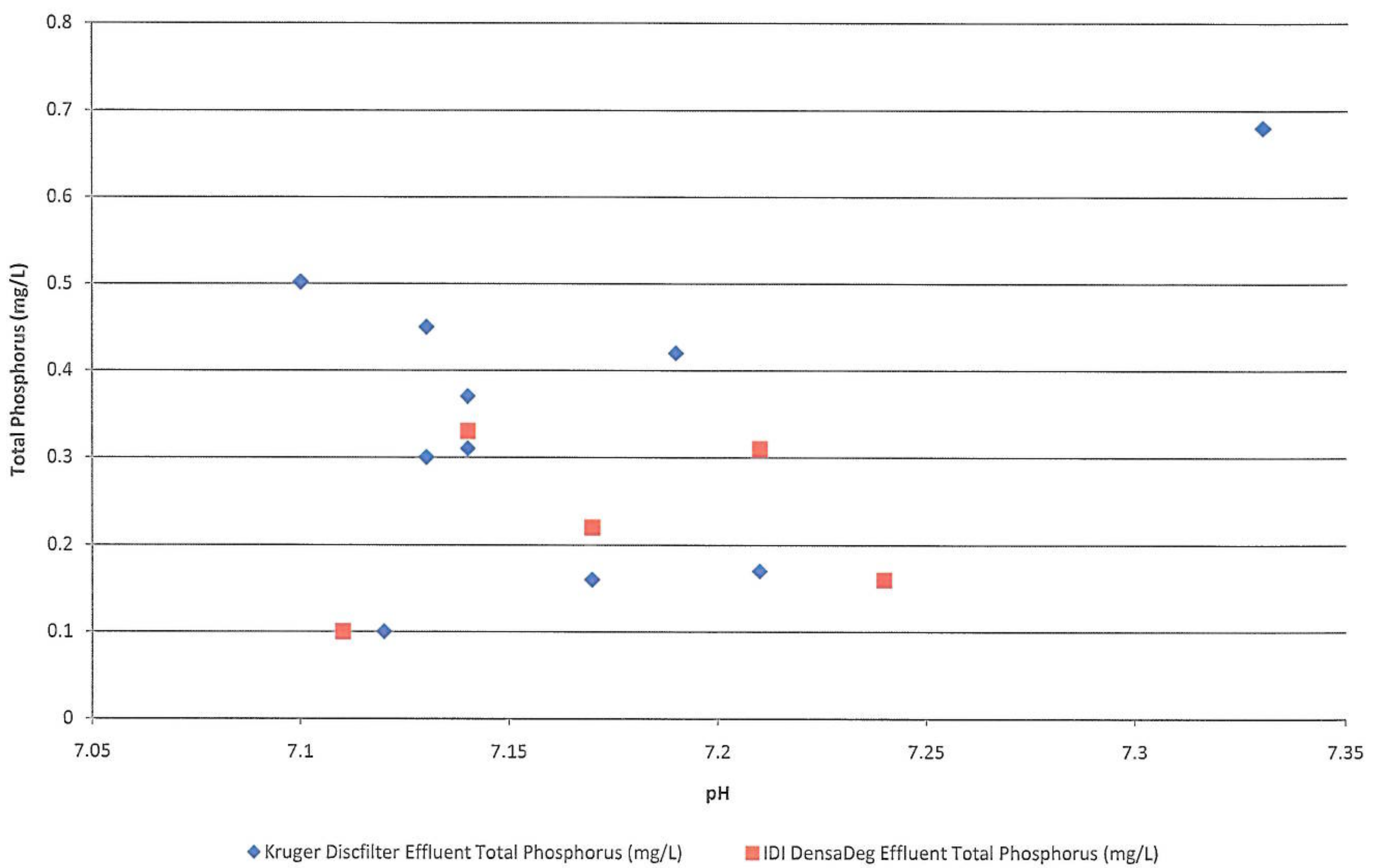


Figure 5-3:
Flow Temperature vs. Total Phosphorus
Total Phosphorus (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
8
8.5
9
9.5
10
10.5
11
Flow Temperature (°C)
Kruger Discfilter Effluent Total Phosphorus (mg/L)
IDI DensaDeg Effluent Total Phosphorus (mg/L)

Figure 5-4: pH vs. Total Phosphorus



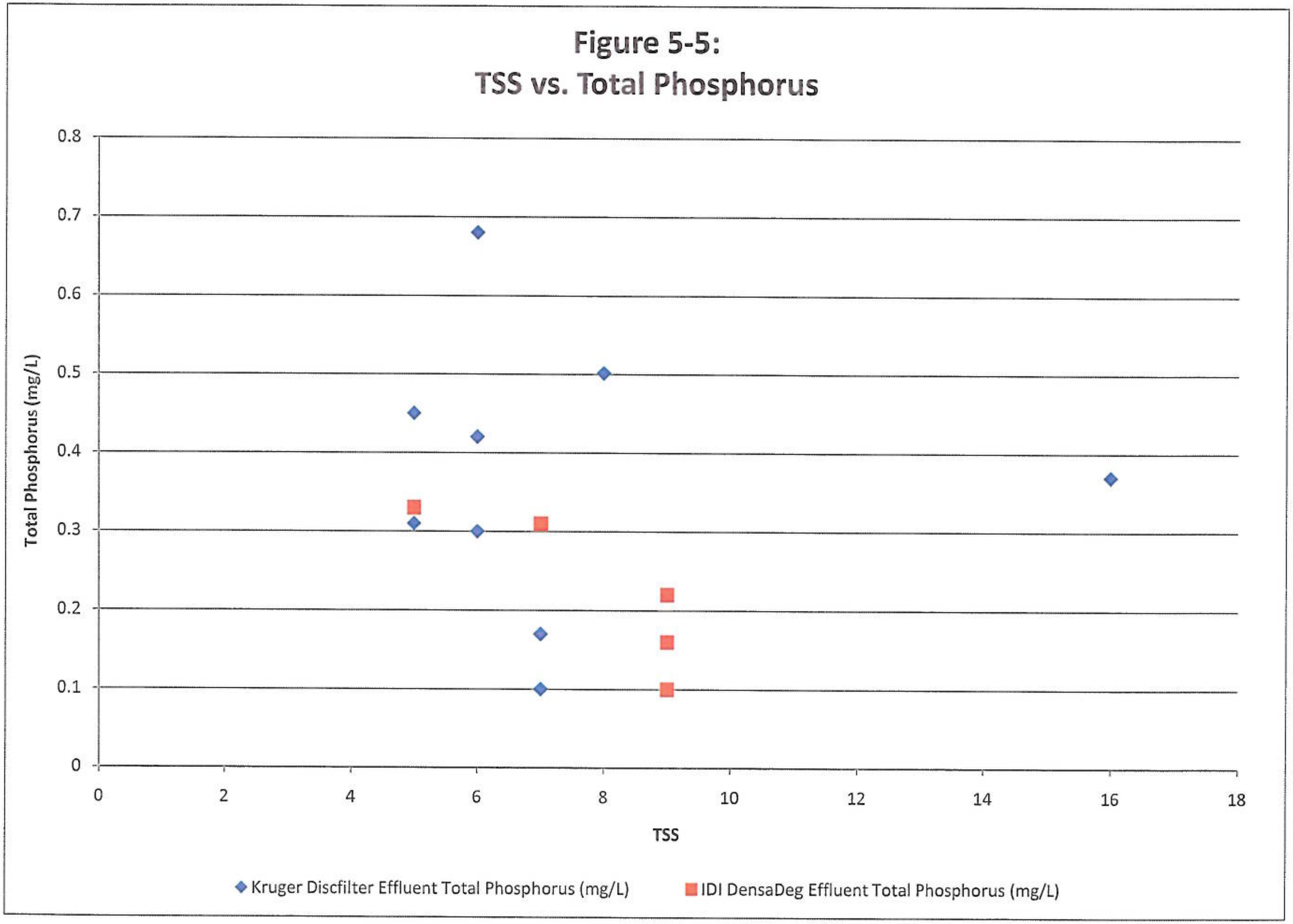


Figure 5-5:
TSS vs. Total Phosphorus
Total Phosphorus (mg/L)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
2
4
6
8
10
12
14
16
18
TSS
Kruger Discfilter Effluent Total Phosphorus (mg/L)
IDI DensaDeg Effluent Total Phosphorus (mg/L)

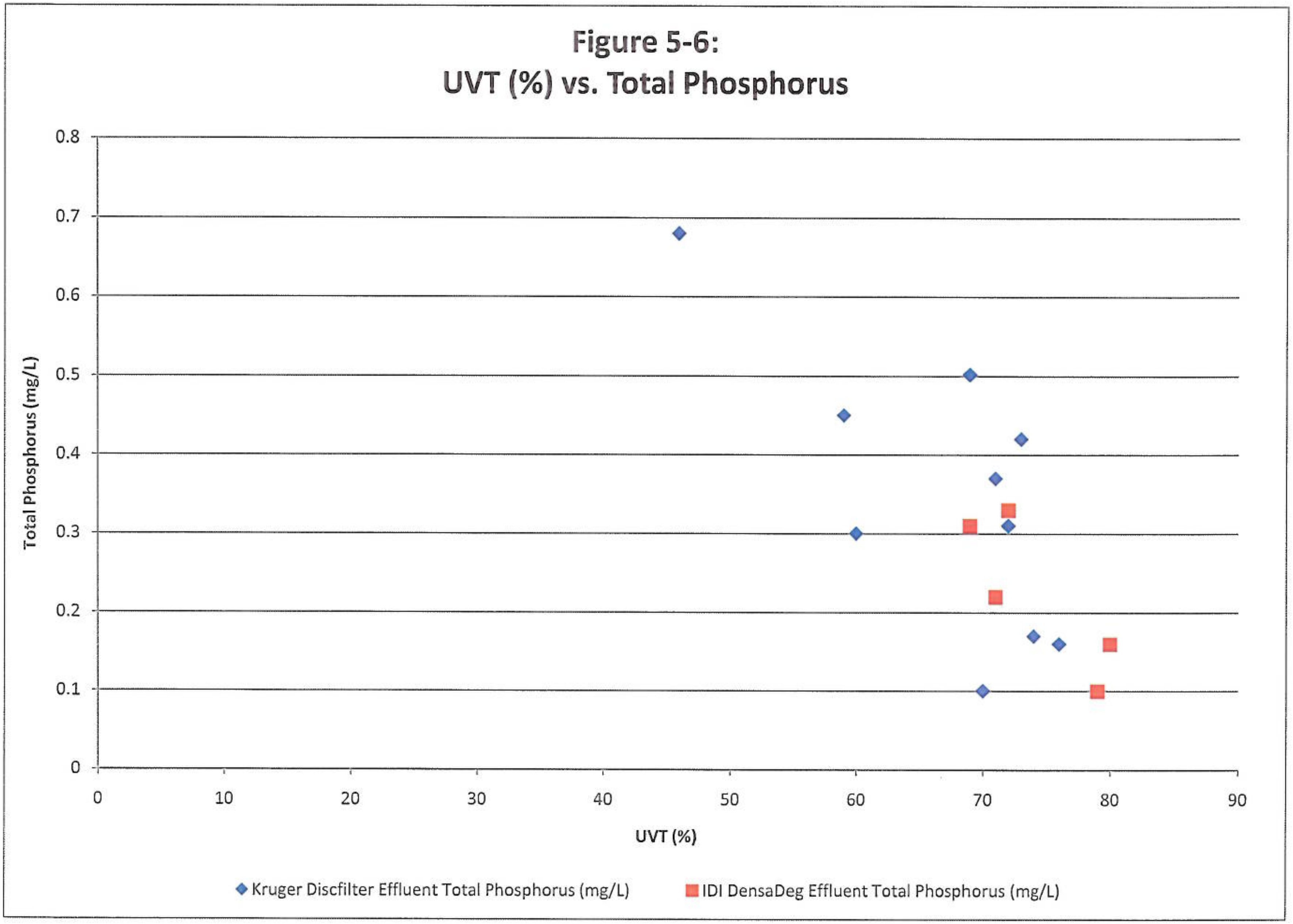
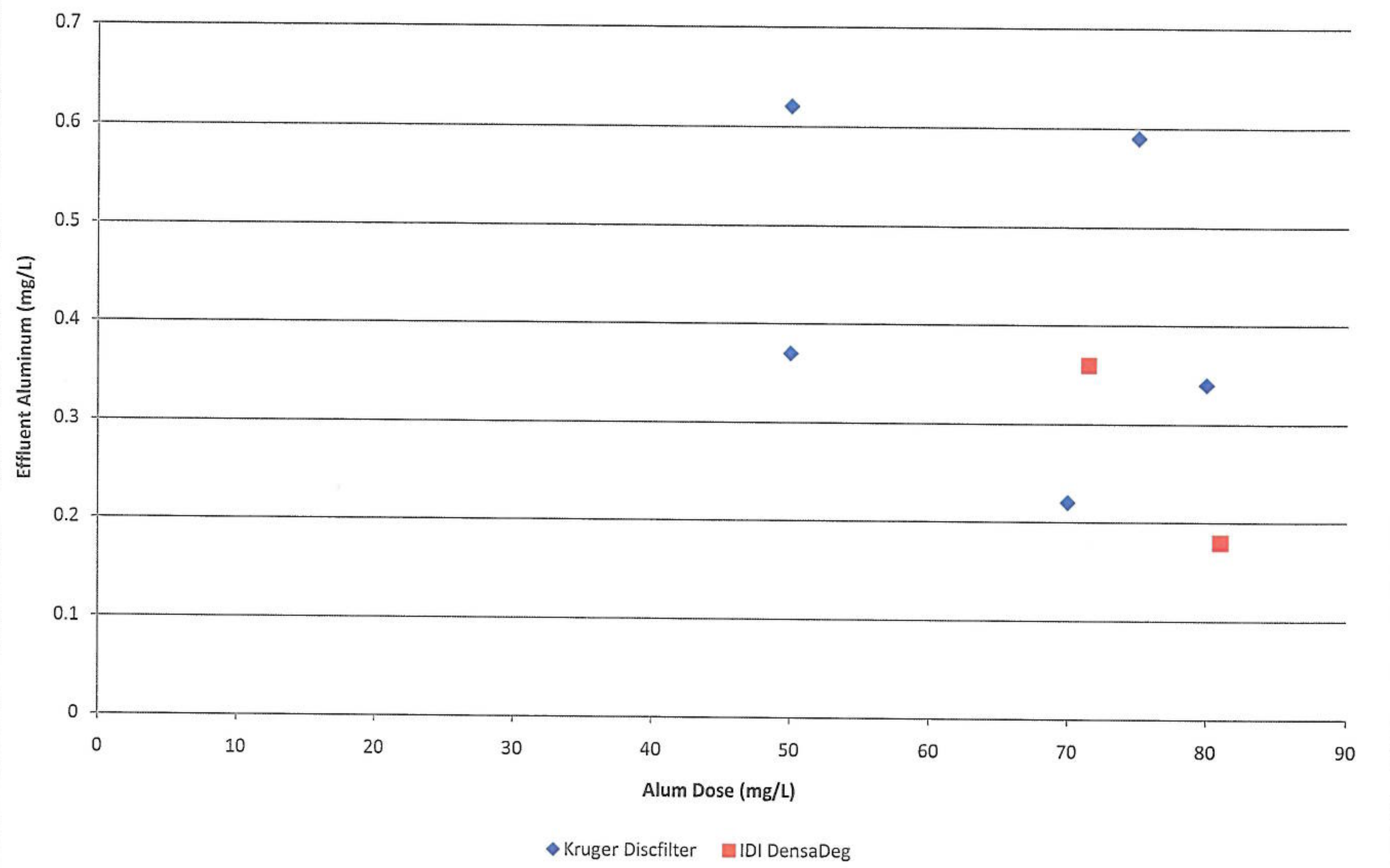


Figure 5-6:
UVT (%) vs. Total Phosphorus
Total Phosphorus (mg/L)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
10
20
30
40
50
60
70
80
90
UVT (%)
Kruger Discfilter Effluent Total Phosphorus (mg/L)
IDI DensaDeg Effluent Total Phosphorus (mg/L)

Figure 5-7:
Alum Dose vs. Effluent Aluminum



6. EVALUATION AND SELECTION OF RECOMMENDED ALTERNATIVE

Selection of the best alternatives is based on an evaluation of cost and consideration for non-monetary concerns that may influence the decision making process. Cost comparisons are made based on a present worth analysis similar to the model developed by EPA for the facilities planning process. The analysis is based upon a 20 year planning period and an annual inflation rate of 3.5%. By taking into account the yearly operating cost and initial capital cost, it is possible to determine the funds that would be required in present day dollars to cover estimated capital and operating expenses for the planning period at the interest rate selected. This is called the present worth value of the investment. The treatment process that has the lowest present worth is the least costly long term alternative.

The economic analysis used in this Plan uses projections for the first year operational costs for such consumables as electrical power and chemicals in 2009 costs. Labor for operation and maintenance of the phosphorus removal equipment is estimated at a rate of $30 per hour, and electricity is $0.13 per kWh. For estimated capital costs of the phosphorus equipment, the current year (2009) cost of the equipment and structures are used. For the selected Plan, peripheral capital costs will be added to the phosphorus removal process and then be escalated to the mid point of the construction project, expected to be at the beginning of 2012.

Non-monetary concerns that may have a bearing on the process selection, must then be addressed. These non-monetary concerns are different for each process and include, among other things, public and treatment plant personnel safety, environmental impacts, the possibility of odor generation, FAA requirements, and other land use requirements. The process scheme that will be selected will be the one that is the least costly based on a present worth analysis and which does not exhibit any overriding non-monetary concerns.

A. ADDRESSING CURRENT LIMITS

The current permitted limits for phosphorus that need to be attained are 0.42 mg/L. Based on piloting results, this level can be consistently achieved with either a coagulation followed by a direct filtration process or a ballasted sedimentation process following the lagoon treatment process. Each process will be reviewed in detail below:

Coagulation followed by direct filtration

As part of the pilot report, a full scale version of the piloted process was proposed and evaluated by AECOM. For the coagulation followed by filtration process, the full scale operation would include a new building housing the chemical storage and feed facilities, coagulation tanks, and cloth media filters. The components housed in this building would include the following:

- A storage tank, including containment, for alum, ferric chloride, polyaluminum chloride, or other metal salt;
- Two chemical metering pumps;
- Miscellaneous piping, electrical, instrumentation, painting, heat, ventilation and plumbing;
- Loading dock for chemical delivery trucks;
- Two coagulation tanks
- Two mixers
- Two disc media filters, with one as a redundant spare;
- Miscellaneous piping, valves, electrical, instrumentation, painting, heat, ventilation and plumbing;
- Piping to get the effluent to the coagulation tanks and filters and returned to the existing UV system, backwash piping, waste piping and a source of service water;
- Headloss through the filters is roughly 8 to 10 inches. Installation of these filters would also involve some additional valves and fittings in the piping, so low head pumping to provide enough head to flow through the filters and UV disinfection process is provided.

Additionally, a filtration process will increase the amount of sludge that needs to be processed in addition to that generated in the lagoons. Unthickened solids storage in the new building would be needed, and pumping and a method of dewatering the unthickened sludge would be required. The press solids could either be stored in a roll-off container or further processed to a dryer condition in geobags.

A site plan identifying the location of the necessary structures is shown in Figure 6-1.

Ballasted sedimentation process

For a ballasted sedimentation process, the structures and equipment would include:

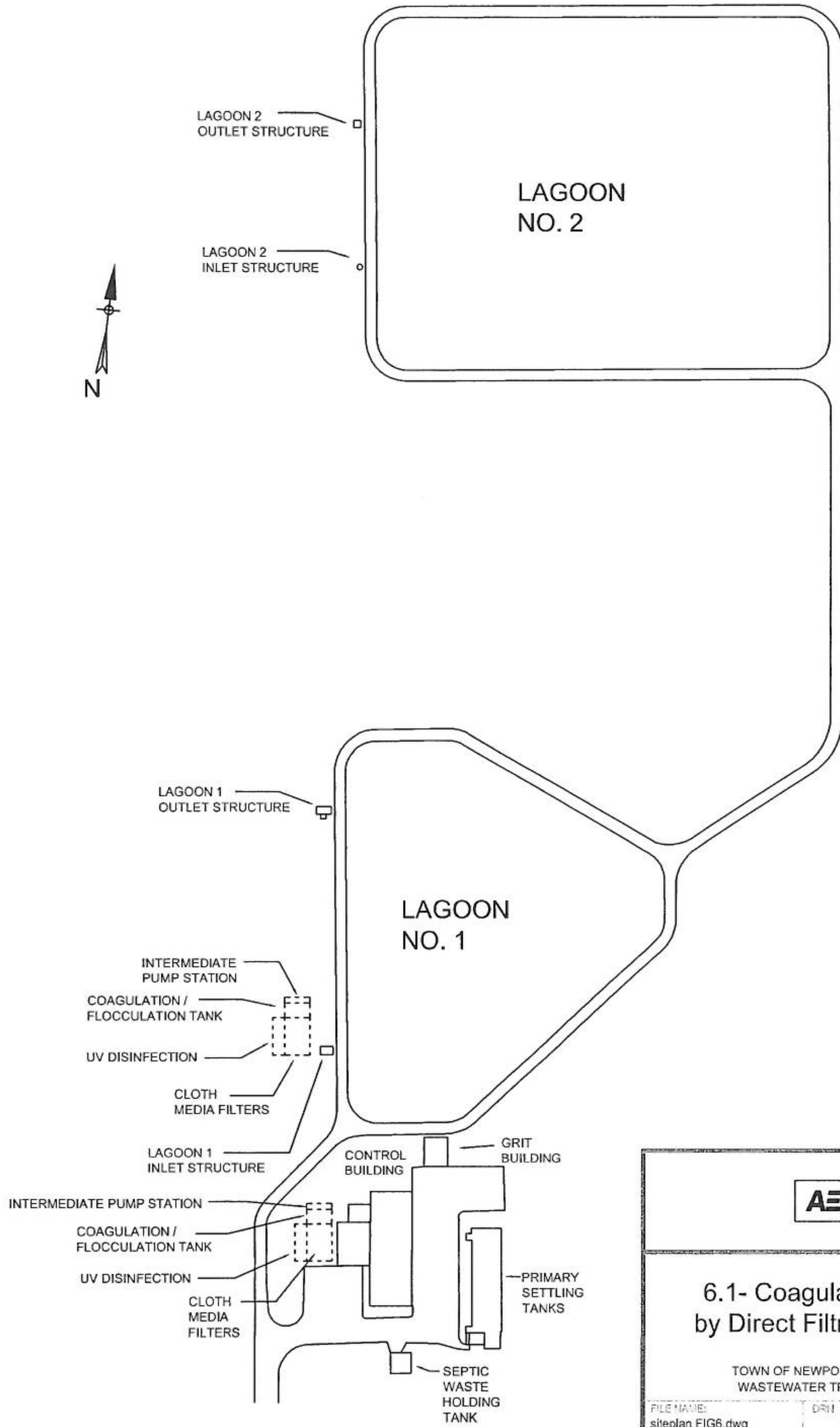
- A new building housing the chemical storage and feed facilities and the process itself. The components housed in this building would include the following:
- A storage tank, including containment, for alum, ferric chloride, polyaluminum chloride, or other metal salt;
- Two chemical metering pumps;
- Loading dock for chemical delivery trucks;
- Redundant ballasted sedimentation processes;
- Miscellaneous piping, valves, electrical, instrumentation, painting, heat, ventilation and plumbing;
- Piping to get the effluent to the ballasted process and returned to the UV system, backwash or recycle piping, waste piping and a source of service water.
- A new pump station to lift the flow after the lagoons and provide enough head to flow through the ballasted process and UV disinfection process.

Additionally, a ballasted process will increase the amount of sludge that needs to be processed in addition to that generated in the lagoons. Unthickened solids storage in the new building would be needed, and pumping and a method of dewatering the unthickened sludge would be required. The press solids could either be stored in a roll-off container or further processed to a dryer condition in geobags.

A site plan identifying the location of the necessary components is shown in Figure 6-2 for the ballasted sedimentation process.

In addition to the capital costs of the installation of equipment and structures related to phosphorus removal, there are also operational costs such as power, maintenance, chemical cost, and labor that need to be taken into account for phosphorus removal. This cost-effective evaluation is included in Table 6-1. Included in this present worth table are the capital costs of the phosphorus removal part of the project that are identified in the bullets above plus the cost of solids processing. Based on this analysis, the most cost effective process for removing phosphorus to less than 0.42 mg/L is coagulation followed by direct filtration.

Full capital costs of this upgrade are presented later in this chapter.



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6.1- Coagulation Followed by Direct Filtration Site Plan

TOWN OF NEWPORT, NEW HAMPSHIRE
WASTEWATER TREATMENT FACILITY

FILE NAME:	DRN	PROJECT NO.	DATE	FIGURE NO.
siteplan FIG6.dwg		60131133	1/21/2010	6.1

TABLE 6 - 1
PRESENT WORTH ANALYSIS FOR PILOTED TECHNOLOGIES

	TP7 BALLASTED SEDIMENTATION PROCESS	**TP-9 COAGULATION FOLLOWED BY DIRECT FILTRATION**
CAPITAL COSTS		
CONSTRUCTION COSTS		
DEMOLITION	$50,000	$50,000
CIVIL	$101,000	$20,000
STRUCTURAL	$531,000	$175,000
ARCHITECTURAL	$1,100,000	$388,000
MECHANICAL	$1,810,000	$1,940,000
HVAC	$93,000	$77,000
ELECTRICAL	$131,000	$142,000
INSTRUMENTATION	$66,000	$71,000
CONSTRUCTION COST SUBTOTAL YEAR 2010	*$3,890,000*	*$2,870,000*
ANNUAL OPERATING COSTS		
ELECTRICAL POWER	$19,400	$17,400
CHEMICALS	$52,400	$45,400
FILTER REPLACEMENT		$5,200
OPERATION & MAINTENANCE	$18,800	$15,600
ANNUAL OPERATING COST	**$90,600**	**$83,600**
OPERATING COST PRESENT WORTH	$1,287,000	$1,188,000
TOTAL CAPITAL COST	$3,890,000	$2,870,000
PRESENT WORTH COST	**$5,177,000**	**$4,058,000**

B. POTENTIAL FUTURE PERMIT LIMITS

As part of the evaluation, AECOM contacted NHDES, EPA, and convened internal discussions to develop an understanding of likely future permit limits for phosphorous, aluminum, and nitrogen. These permit limits are based on an in-stream limit developed by NHDES and EPA, a background stream concentration, and a dilution factor for the effluent. The Town's dilution factor is 7.5 and applies to limits for every constituent.

Phosphorus

For phosphorous, the current 0.42 mg/L limit is based on an in-stream criteria of 0.1 mg/L, a plant permitted flow of 1.3 mgd, and a background phosphorus concentration of 0.045 mg/L. Taking in stream dilution into account during the 7Q10 stream flow results in a 0.42 mg/L effluent limit for phosphorus, which is the current permitted limit. The current in-stream criteria of 0.1 mg/L has been developed by NHDES and EPA and has historically been accepted by EPA in New Hampshire and other states for use in calculations of phosphorus limits with 7Q10 stream flows. EPA has mentioned a lower criteria of 0.065 mg/L in discussions and this has been used as a criteria in other states (New York is one), but this lower criteria has not been acted on anywhere in New Hampshire or other New England states (unless there is a specific in-stream water quality issue which is not the case here) nor is there an indication that this is on the near term horizon. If the criteria of 0.065 mg/L were to be enforced in the future, this would result in an effluent Total Phosphorous limit of 0.16 mg/L for the Town at its current permitted flow of 1.3 mgd.

Since the permitting agencies calculation for in-stream dilution includes the permitted plant flow of 1.3 mgd, AECOM recalculated Newport's permit limits based on a lower plant flow as identified in Chapter 3 of 838,000 gpd. The phosphorus limits would increase to 0.60 mg/L for a stream limit criteria of 0.1 mg/L. An evaluation of this increase in phosphorus limits indicates that whether the phosphorus limits would be 0.42 mg/L or 0.60 mg/L, this would not change the need to install a treatment system similar to those that were piloted, so there is no advantage to requesting a lower permitted flow limit for this criteria. Another concern with requesting a lower permitted flow limit is that once granted, the higher, 1.3 mgd flow limit will not be allowed again – essentially restricting growth of the sewer collection system.

For the potential stream limit of 0.065 mg/L, the improvement in permitted phosphorus would be to an effluent limit of 0.21 mg/L instead of 0.16 mg/L. The evaluation of the potential lower criteria of 0.16 mg/L or 0.21 mg/L TP limit and consistent attainability is more complex. We would believe based on pilot results that the 0.21 mg/L effluent limit would be significantly more likely to be consistently attained than a 0.16 mg/L limit with either the ballasted sedimentation of direct filtration processes.

Aluminum:

For aluminum, the in-stream limit for acute exposure is 0.75 mg/L which would result in a daily maximum concentration of 5.6 mg/L in the treatment plant effluent. The in-stream limit for chronic exposure is 0.087 mg/L which would result in a monthly average concentration of 0.65 mg/L. An aluminum limit can be expected if the Town were to begin to use an aluminum based coagulant as part of its treatment process. Based on pilot results, meeting an aluminum limit using an aluminum based coagulant for phosphorus removal is not a concern.

Nitrogen

NHDES staff was not able to provide input into potential future nitrogen limits however AECOM has had previous discussions with EPA regarding this issue. Given the limits that will begin to be enforced in the communities surrounding the Great Bay in southern New Hampshire (3 mg/l Total Nitrogen) and the Connecticut River communities (5.6 mg/l average), it is likely that there will be a total nitrogen limit in the future for all communities discharging to the Connecticut River north of the Connecticut border, and that there will be a nearer term requirement to maintain levels of total nitrogen discharges at current levels. Without any indication from NHDES or EPA as to what this final total nitrogen limit might be, AECOM has estimated that will be 8 mg/L for the purposes of this evaluation of nitrogen removal processes. Given the goals of the Long Island Sound program, the attenuation capacity of the river, and the discharge location of the river, this limit is a reasonable estimate.

C. TREATMENT PROCESSES – POTENTIAL FUTURE LIMITS

Using the alternatives designations discussed in previous chapters and modifying them as needed to meet potential lower phosphorus limits and potential nitrogen limits, AECOM developed several options for further evaluation to meet the current and future potential phosphorous limits, and also for meeting future potential phosphorus and nitrogen limits. These options are listed in Table 6-2 below and described in detail in subsequent paragraphs.

Table 6-2: Potential Treatment Solutions

Option	P-limit	N-limit	Proposed solution
TP-9a	0.16 mg/L	N/A	Coagulation followed by direct filtration modified with covers over lagoons
TP-7a	0.16 mg/L	N/A	Ballasted sedimentation modified with covers over lagoons
TP-1a	0.16 mg/L	N/A	SBR with Chemically Enhanced P-Removal
TP-1	0.16 mg/L	8 mg/L	SBR with Chemically Enhanced P-Removal

Option TP9a – Coagulation followed by direct filtration modified with covers over lagoons

At the lower permit limit of 0.16 mg/L, the cloth media filters show sporadic success as an add-on process after the lagoons – and the better results for these filters have been with iron salts, which are generally not preferred for operation with UV disinfection. To improve performance of the filters, the lagoons could be covered to eliminate sunlight and prevent algal growth – which we believe to be the major issue in attaining lower phosphorus numbers. Historic data with cloth filters following activated sludge processes indicates the ability to attain phosphorus to the 0.16 mg/L level, however, a lagoon is not an activated sludge process used in this historical context. So even with the lagoon covers, there is a risk that this solution would not consistently attain the permit limit. That coupled with the difficult accessibility of equipment now located under lagoon covers and the added maintenance cost and safety concerns, we do not believe that this is a viable alternative to achieving consistent lower phosphorus results with lagoons.

Option TP7a – Ballasted sedimentation modified with covers over lagoons

Another option to meet a lower phosphorous limit would be the addition of a ballasted sedimentation process after the lagoons. Based on the results of the pilot testing, covers over the lagoons would be suggested even with the addition of a ballasted process. The IDI DensaDeg process did not maintain an effluent Total Phosphorous level below 0.16 mg/L using an aluminum based coagulant, and had its best results with an iron salt. Removal of algae should improve its performance. There remains a risk that this process may not perform to the level necessary even with the covers and this option would be more expensive than installing a coagulation and direct filtration process. That coupled with the difficult accessibility of equipment now located under lagoon covers and the added maintenance cost and safety concerns, we do not believe that this is a viable alternative to achieving consistent lower phosphorus results with lagoons.

Option TP1a - SBR with Chemically Enhanced P-Removal

A final option to meet the expected future phosphorous limit would be to decommission the existing lagoons and construct an activated sludge process such as a Sequencing Batch Reactor (SBR) process with chemically enhanced phosphorus removal. This alternative would require a tertiary filter such as coagulation followed by filtration to meet the effluent limit.

An SBR process will result in a complete demolition of the lagoon treatment system and replacement with an SBR. It will result in a more mechanical treatment process with numerous pumps, blowers, valves and gates. Some of the existing equipment for the lagoons may be able to reused for the SBR such as the blowers. As mentioned above, a tertiary treatment process such as a media filter for phosphorous removal would also be necessary. Using an SBR process would also result in a steady flow of sludge that would need to be stored and mixed at a minimum.

An advantage of using an SBR or other activated sludge process for biological phosphorus removal process is that during the winter months (when the total phosphorus limit is 1 mg/l) the addition of chemicals might not be necessary and biological treatment would be the sole method of phosphorus removal. This mode of operation would save energy, sludge processing and disposal, and chemical costs.

Option TP1 - SBR with Chemically Enhanced P-Removal and Nitrogen removal

As mentioned previously in Chapter 4, the only process that was moved forward during the preliminary workshop for nitrogen removal was an activated sludge process such as an SBR with Chemically Enhanced Phosphorous Removal. Other activated sludge processes capable of both nitrogen and phosphorous removal, such as an oxidation ditch, would work, and we would suggest that if this option is to move forward, that a cost effective analysis of the various activated sludge options occur to select the most cost effective.

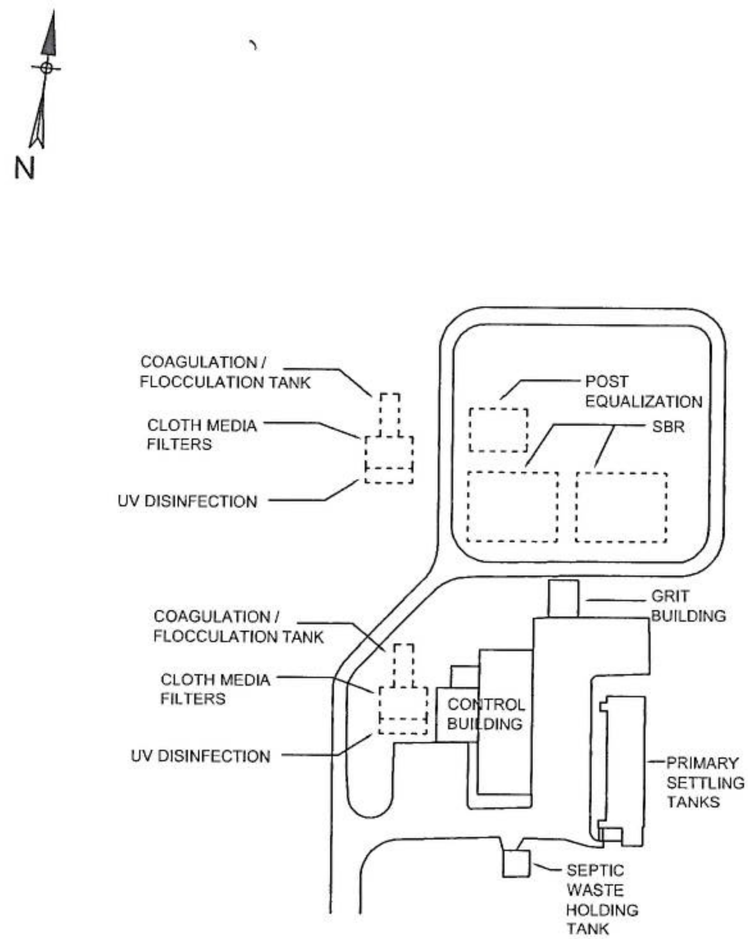
The infrastructure required for this type of process is identical to that listed above as Option TP-1a, including a new SBR process, a new coagulation and direct filtration process, a new solids thickening and storage process, and other associated improvements. Similar to the option above, the operation of the plant in the winter may be able to be modified to eliminate the cloth media filters and rely solely on biological phosphorous removal.

A site plan showing the location of these facilities on the site is included in Figure 6-3.

Evaluation

Of the above options, AECOM believes that Options TP9a, TP 7a, TP1a should not be evaluated further.

Some of the discussion related to this statement above is that these options only address a lower phosphorus removal level, and do not address nitrogen. There are also too many concerns that these lower levels could be not be consistently met with lagoons as the basic treatment process. Additionally, if you are going to decommission the lagoon processes, you may as well design the activated sludge process as for nitrogen removal as well. Option TP1a is a smaller version of TP1, and we would suggest installing a process that would meet both nitrogen and phosphorus before we would recommend one that only addresses phosphorus removal. The cost difference between the two is negligible.



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6.3 - SBR with Chemically Enhanced P-Removal Site Plan

TOWN OF NEWPORT, NEW HAMPSHIRE
WASTEWATER TREATMENT FACILITY

FILE NAME:	DRN	PROJECT NO.	DATE	FIGURE NO.
siteplan FIG6.dwg		60131133	1/21/2010	6.3

After eliminating these three options, the remaining option we would recommend for lower phosphorus removal or nitrogen removal is Option TP1.

AECOM contacted an SBR manufacturer, Aqua-Aerobics, and requested proposals for full scale installations for pricing purposes. The request contained minimum requirements include:

- A minimum of two complete and separate units for redundancy;
- Capable of treating an average of 0.85 million gallons per day (mgd), a maximum month flow of 1.4 mgd and a peak hour flow of 6 mgd.

The vendor proposal includes preliminary equipment lists, layouts, hydraulic considerations, equipment costs, present worth life cycle costs for labor, chemical and electricity, and information regarding equipment required for an operational system. A copy of the manufacturer's proposal is included in Appendix H.

Additional significant installations that would be required and are not included in the vendor proposals include site work and yard piping, interior stairs, process piping, solids handling, electrical installations, instrumentation and SCADA work. These costs have been included in the evaluation.

Table 6-3 presents the cost effective analysis comparing a coagulation followed by direct filtration process, TP-9, and an SBR process, TP1. The costs for TP9 were shown previously in Table 6-1. For the SBR process, the capital and operational costs include costs for the following items:

- Two new SBR tanks;
- One post-equalization tank;
- Two coagulation tanks;
- Two disc media filters, with one as a redundant spare;
- SBR equipment including mixers, decanters, transfer pumps, diffusers, and blowers;
- Solids thickening and storage process;
- Miscellaneous yard piping modifications;
- Chemical storage tanks and metering pumps;
- Loading dock for chemical delivery trucks;

- Building and foundation;
- Miscellaneous piping, valves, electrical, instrumentation, painting, heat, ventilation and plumbing;
- Instrumentation and electrical work.

As can be seen, the cost to address phosphorus removal to current levels is more cost effective than addressing potential future phosphorus and nitrogen limits. Either option is acceptable to address phosphorus removal to the 0.42 mg/L limit, but only TP1 will address potential future phosphorus and nitrogen limits.

Full capital costs both option TP9 and TP1of the recommended upgrade are presented in later in this chapter.

TABLE 6 - 3
PRESENT WORTH ANALYSIS FOR PHOSPHORUS REMOVAL OPTIONS

	TP-9 COAGULATION FOLLOWED BY DIRECT FILTRATION	TP1 - SBR WITH CHEMICALLY ENHANCED P-REMOVAL
CAPITAL COSTS		
CONSTRUCTION COSTS		
DEMOLITION	$50,000	$250,000
CIVIL	$20,000	$180,000
STRUCTURAL	$175,000	$1,290,000
ARCHITECTURAL	$388,000	$1,244,000
MECHANICAL	$1,940,000	$2,676,000
HVAC	$77,000	$170,000
ELECTRICAL	$142,000	$210,000
INSTRUMENTATION	$71,000	$105,000
CONSTRUCTION COST SUBTOTAL YEAR 2010	*$2,870,000*	*$6,130,000*
(includes solids handling improvements)		
ANNUAL OPERATING COSTS		
ELECTRICAL POWER	$17,400	$91,900
CHEMICALS	$45,400	$73,900
FILTER REPLACEMENT	$5,200	$5,200
OPERATION & MAINTENANCE	$15,600	$12,500
ANNUAL OPERATING COST	**$83,600**	**$183,500**
OPERATING COST PRESENT WORTH	$1,188,000	$2,606,000
TOTAL CAPITAL COST	$2,870,000	$10,695,740
PRESENT WORTH COST	**$4,058,000**	**$13,301,740**

D. VIABLE OPTIONS AND SELECTED PLAN

Table 6-4 provides a capital cost breakdown of TP1 and TP9 options. Both will reduce phosphorus levels to less than the permitted level of 0.42 mg/L. TP1 is the only option that will address lower phosphorus levels and nitrogen removal.

The selected plan is Option TP9, coagulation followed by filtration with a cloth media filter. This is recommended over an SBR process, Option TP1, because of cost and questionable need.

The logic for not suggesting addressing potential future limits at this time with an SBR activated sludge process, TP1, is as follows:

- the phosphorus removal process selected, Option TP9, is needed for lower treatment levels regardless;
- it is too premature to say when, or if ever, new permit limits for phosphorus or nitrogen will be enacted;
- there is no consensus as to what these lower levels will be;
- lower permit limits may be so far into the future that new technologies become available to address these new permit needs
- maintaining current nitrogen loadings is possible by reducing suspended solids in effluent via the recommended filtration process.

In implementing Option TP9, we would provide space and room in the hydraulic profile for a future activated sludge process whether it is an SBR process or other activated sludge process. The capital cost of this option is $5,238,000.

TABLE 6 - 4
CAPITAL COST OF VIABLE OPTIONS

	TP-9 COAGULATION FOLLOWED BY DIRECT FILTRATION	TP1 - SBR WITH CHEMICALLY ENHANCED P-REMOVAL
CAPITAL COSTS		
CONSTRUCTION COSTS		
CONSTRUCTION COST SUBTOTAL FROM TABLE 6-3 *(includes solids handling improvements)*	$2,870,000	$6,130,000
CONSTRUCTION COST	$2,870,000	$6,130,000
CONTINGENCY (30%)	$870,000	$1,840,000
CAPITAL COST SUBTOTAL	$3,740,000	$7,970,000
CONTRACTOR OVERHEAD AND PROFIT (10%)	$374,000	$797,000
CONSTRUCTION COST TOTAL	***$4,114,000***	***$8,767,000***
PROFESSIONAL SERVICES (20%) *(includes legal and administrative)*	$823,000	$1,754,000
TOTAL CAPITAL COST YEAR 2010	**$4,937,000**	**$10,521,000**
ESCALATION TO YEAR 2012	**$5,238,000**	**$11,162,000**

E. EXISTING FACILITIES IMPROVEMENTS

The design and implementation of the phosphorus treatment options was presented above. As discussed in Chapter 2, there are other unit treatment processes that are not directly related to phosphorus removal but have been indentified for improvement or replacement. This includes correction of existing facility operational, reliability, NHDES regulations, or safety problems, and the need for replacement or enhancement of unit process operations.

These items are taken into consideration during the development of the complete wastewater treatment facilities plan. Since they are not directly related to treatment for the pending permit requirement or have not been included in the phosphorus removal part of the project, these can be included in a long-term capital improvement plan and completed over a period of time, or can be included in a larger project that includes the phosphorus removal processes recommended. The costs of these individual tasks are included in Table 6-5 and include the cost of equipment from manufacturer's quotations plus peripheral installation needs. It is assumed for cost estimating purposes that these tasks would be mostly handled by Newport staff or by local contractors and that engineering services for this work would include design work only and with a minimum amount of construction oversight. The improvements are described below:

1. Control Building Equipment

Replacement of the air side of the second blower and replacement of the influent flow measurement device is recommended.

2. Grit Building

Replacement of the existing grit system is recommended. The existing Eutek Teacup system has replaced the aerated grit basin but does not have the capacity to address higher plant flows. Additionally, the grit classification and dewatering system is comprised of off-the-shelf items and is a highly manual operation.

Replacement of the grit system could take several forms. The most basic form would be a rehabilitation of the existing building using the previous aerated grit system. Because of the prior operational issues associated with this system and high energy costs, rehabilitation of the former grit system is not recommended. Other possibilities include retrofitting the existing building with a new grit removal process or installing an outdoor system vortex grit system with classifiers and washers inside the building.

The existing building has a square footage of approximately 800 sf. This small size limits which grit systems could be retrofit into the existing building. Barring re-activating the aerated grit system, a good option appears to be vortex grit unit similar to the Eutek Headcell system or a vortex system similar to a PistaGrit system.

Based on a budgetary proposal from the manufacturer, the Headcell unit would need to be located at the existing floor level of 787. Ideally this unit would fit within the existing aerated grit tank, but the tank is too narrow and the surrounding foundation is not conducive to expansion. The existing aerated grit tank would need to be filled in or covered to provide enough floor area for the process and the accompanying grit classification process. Only one unit could fit in the building and the tank would reach the ceiling. It is likely that the raw wastewater would need to be pumped to an elevation of roughly 800, or approximately 13 feet above the finished floor. The height of the unit would necessitate a skylight for access.

In a Headcell process, grit is pumped from the bottom of the process to a grit classification process. Eutek recommends a Eutek Teacup paired with a Eutek Grit Snail. This unit is also very tall and would limit access. A grit cyclone/classifier similar to Wemco Hydrogritter would also work and would provide easier access for maintenance.

The Smith & Loveless PistaGrit system is an alternative option and is commonly installed in a covered channel exterior to the building. Grit would be pumped to the grit classification process which would be housed in the existing building.

3. Lagoon Number 1 and Number 2

There are no major upgrades recommended to Lagoon Number 1.

The earthen structure of Lagoon Number 2 should be reinforced in locations where it has failed. The exact nature of the failure and the repairs needed should be investigated further by a geotechnical engineer however, our preliminary analysis suggests that the earthen structure would need to be rebuilt in the areas where it has sloughed off.

Additionally, the ductile iron air line running to this lagoon should be replaced with a new pipeline of a more corrosion resistant material.

4. **UV Radiation Disinfection**

While the current UV Disinfection system currently operates well, spare parts are becoming increasingly hard to find, the surrounding building is not weather-proof resulting in freezing issues nor is the building large enough for proper access around the channel. AECOM recommends that the UV Disinfection system be replaced entirely with new channels, new equipment, electrical, instrumentation and a new structure. These upgrades will alleviate concerns over the availability of spare parts, eliminate freezing issues, meet current NHDES regulations, and provide better access for maintenance.

A new channel for ultimately replacing the UV disinfection equipment is included in the new building for the phosphorus system upgrade. The equipment itself can be installed as part of the phosphorus upgrade or can be included in a capital improvement plan. It is more cost-effective to install at this time, but the cost of replacement is high, and the preference may be to defer this for a later time.

5. **Sludge Drying Beds**

The volume of sludge generated at this facility because of the additional phosphorus removal process is significant. Costs for improvement to solids handling are included in the phosphorus removal project. However, if it is desired to further dewater the sludge in the geobags, a covered sludge storage location and improvements to the geobag storage location would be recommended.

6. **Septage**

Improvements to the septage holding tank are relatively minor and are predicated on the current levels of septage continuing. We would not recommend additional septage acceptance as long as lagoons are kept in operation. Improvements include:

- Repair the existing concrete;
- Coat the inside of the tank;
- Replace mixer with more energy efficient mixer.

F. EXISTING PROCESSES IMPROVEMENT CAPITAL COSTS

The unit processes identified above are projects that could either be included in the phosphorus removal project identified above, or could be part of a long-term capital improvement program. If part of a capital improvement program, prioritizing the work provides a means to address more important issues first, and those that are likely to remain serviceable last. Table 6-5 suggests a plan for this capital improvement project. The capital cost for these improvements is $2,226,000.

TABLE 6-5
CAPITAL COST - IMPROVEMENTS TO CURRENT UNIT PROCESSES
TOWN OF NEWPORT

CONSTRUCTION TASK	CONSTRUCTION COST	CONTINGENCY	CONTRACTOR O & P	ENGINEERING	CONSTRUCTION ADMIN	LEGAL & ADMIN	CAPITAL COST	IMPROVEMENT TIMELINE
1. MISCELLANEOUS IMPROVEMENTS	$50,000	$5,000	$5,000	$10,000	$0	$0	$70,000	2016
2. GRIT SYSTEM IMPROVEMENTS	$510,000	$102,000	$51,000	$40,000	$11,000	$0	$714,000	2015
3. LAGOON 2 IMPROVEMENTS	$150,000	$15,000	$15,000	$20,000	$10,000	$0	$210,000	2012
4. UV DISINFECTION	$720,000	$144,000	$72,000	$50,000	$22,000	$0	$1,008,000	2013
5. EXISTING SLUDGE HANDLING OPERATION	$70,000	$11,000	$7,000	$10,000	$0	$0	$98,000	2014
6. SEPTAGE MANAGEMENT	$85,000	$12,750	$8,500	$15,000	$4,750	$0	$126,000	2016
CONSTRUCTION TASK TOTAL YEAR 2010							$2,226,000	
CONSTRUCTION TASK TOTAL YEAR 2012							$2,362,000	

Appendix A

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act, as amended, (33 U.S.C. §1251 et seq.; the "CWA"),

Town of Newport, New Hampshire

is authorized to discharge from the Town of Newport Wastewater Treatment Facility located at

20 Putnam Road
Newport, New Hampshire 03773

to the receiving water named:

Sugar River (Hydrologic Basin Code: 01080104)

in accordance with the effluent limitations, monitoring requirements, and other conditions set forth herein.

This permit shall become effective on July 1, 2007.

This permit and the authorization to discharge expire at midnight June 30, 2012.

This permit supersedes the permit issued on January 29, 2001.

This permit consists of 10 pages in Part I including effluent limitations, monitoring requirements, etc., Attachment A (Freshwater Chronic Toxicity Test Protocol), Sludge Compliance Guidance, and Part II including General Conditions and Definitions.

Signed this 18th day of APRIL, 2007

Stephen S. Perkins, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency
Region I
Boston, Massachusetts